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Leaking Underground Fuel Tank Historical Case Analysis: Recent Findings and Application to Risk Management Decision Making

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Two recent statistically-based historical case analysis studies (Rice et al., 1995, and Mace et al. 1997) have sparked debate on the self-limiting life-cycle of fuel hydrocarbon (FHC) plumes and when the use of natural attenuation as a risk management approach is appropriate. Both studies have indicated that FHC plumes are limited in spatial extent, stabilizing and in many cases receding at relatively short distances from the point of release. In California, benzene plume lengths were investigated for over 1,200 sites and compared with estimates determined using hand drawn plumes and best professional judgment. Using forecasts derived from a Monte Carlo analysis of an analytical solution to the advection-dispersion solute transport equation, plume length distributions simular to that observed in the field were produced. These forecasts include as input parameters probability distribution functions (PDFs) that are derived using historical case data, as well as best professional judgment.

Forecast distributions of plume lengths, the general trend of plume length vs. maximum site concentration, and the plume life-cycle of growth, stability and decline, are in good agreement with the statistically-based historical case studies. An understanding of the mechanisms of plume life-cycles can then be derived. We suggest that when site hydrogeological information is sparse or non-existent, the above method may be used to estimate data and to predict FHC plume behaviour at a specific site in question. The uncertainty associated with this prediction will also be known, allowing risk managers to gather site specific data that may reduce uncertainty to a tolerable degree. The hazard posed by residual hydrocarbons to current or probable future receptors would depend on the conservative assumptions that indicate probable risk to those receptors.

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